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OCEAN ENVIRONMENTAL MANAGEMENT

Climate change impacts on marine ecosystem

Biological systems under stress



Marine life forms are fundamentally well adapted to natural variations in environmental conditions. They can even tolerate extreme situations for a limited time.

But climate change is altering some habitats so severely that the stress becomes too great for many species. Where several unfavourable factors combine, the cumulative effect can cause the extinction of species.



Changing habitats

- Marine plants and animals are also subject to stressors by changes in their habitat conditions.
- It could be due to increased sedimentation from a storm burying bottom dwellers, or an algal bloom causing light deficiency in deep water layers .
- At a particular location and time, the temperature, light availability and pH can all drift outside the range optimal for an organism.
- Sometimes introduced species can also act as stressors

 as predators, pathogenic agents, or feeding competitors.



Changing habitats

- The various stressors can create integrated effects (combined, amplified).
- In many cases the stressors initially only impair the productivity of an organism in some way, then alters the interactions of the weakened organism with its environment, with predators, parasites, competitors, pathogens or reproductive partners.
- These effects can significantly exceed the primary effects of the stressors such as the stress caused by light deficiency.



Too many environmental changes at once

- The most common stressors on marine ecosystems amplified by climate change include:
 - Acidification of seawater
 - Warming of seawater and associated secondary effects
 - Salinity in marginal seas
 - Eutrophication
 - Changes in near-coastal current and sedimentation processes
 - The spread if exotic species into new habitats



Too many environmental changes at once

- Coral refers to actual organisms and also the structures they create.
- Individual corals are coral polyps. Coral polyps take calcium carbonate from seawater to form rocky skeletons. Together, they form coral reefs.
- Corals need symbiotic algae living in their tissues, called zooxanthelae. Both benefit from the relationship.







Too many environmental changes at once

- **Coral bleaching**: When corals get stressed, from things such as heat or pollution, they react by expelling this algae (zooxanthellae), leaving a ghostly, transparent skeleton behind. This is known as 'coral bleaching'.
- Some corals can feed themselves, but without the zooxanthellae most corals starve.







Disruption to the plankton cycle

Phytoplankton

Zooplanktion





Essential single-celled organisms

- Phytoplankton, (algae and cyanobacteria), take up nutrients dissolved in the water, grows, and undergoes cell division.
- Biomass is thus produced, on which zooplankton such as copepods feed.
- The zooplankton, in turn, is eaten by fish and their larvae.
- Plankton therefore plays a key role in the biogeochemical cycle of the ocean.



Faltering plankton growth

- Because the plankton consists of short-lived organisms, it reacts rapidly to physical and chemical changes in the ocean and to fluctuations in nutrient availability.
- The size of populations can sometimes vary greatly within a few days or weeks.
- The ranges of some planktonic species are shifting toward the poles in response to ocean warming.



Mounting threat of harmful algal blooms

- Harmful algal blooms (HABs) are massive growths of toxic or otherwise harmful phytoplankton.
- Eutrophication, the increased concentration of nutrients in the water, is considered to be the main cause, but climate change also appears to play a role.
- Harmful algal blooms normally occur in the summer months when the water column is thermally stratified.

Species encroaching on alien territories





Causes of the dispersal of marine organisms

- Since humans began to sail the seas, other species have been travelling around the globe with them
- The threat of invasive species Jennifer Klos: <u>https://www.youtube.com/watch?v=spTWwqVP_2s</u>
- Invasive crayfish threaten species in Oregon's Crater Lake:
 - https://www.youtube.com/watch?v=8mN09yvL5YE &t=70s



New species alter biodiversity

- Many exotic species infiltrate the native flora and fauna without dominating them, thus increasing the diversity of the species association.
- Natural catastrophes can completely destroy habitats and be fatal to entire species communities.
- Cases of newly imported species displacing native species have been documented in 78 per cent of the 232 coastal ecoregions of the world.
- Many cases have been reported from the temperate latitudes in particular, those regions of the Earth where it is neither extremely hot nor extremely cold.



Economic impacts of alien species





Can future introductions be avoided?

- Caution is necessary when dealing with foreign marine organisms because species introduction is largely irreversible.
- Government policy and environmental management will therefore have to take a stronger stance to control the primary causes of species introduction.
- Unilateral efforts at the national or local levels, however, will hardly be effective.
- International strategies practiced by all states bordering an ecoregion have greater chances of success.



THANK YOU FOR NOT SLEEPING

